
MEASUREMENT OF ^{235}U FISSION NEUTRON SPECTRA USING A MULTIPLE GAMMA COINCIDENCE TECHNIQUE

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The Los Alamos Model [1] predicts the shape of the fission neutron energy spectrum for incident primary neutrons of different energies. Verifications of the model normally are limited to measurements of the fission neutron spectra for energies higher than that of the primary neutrons because the low energy spectrum is distorted by the admixture of elastically and inelastically scattered neutrons. This situation can be remedied by using a measuring technique that separates fission from scattering events. One solution consists of using a fissile sample so thin that fission fragments can be observed indicating the occurrence of a fission event. A different approach is considered in this paper. It has been established that a fission event is accompanied by the emission of between seven and eight gamma rays, while in a scattering interaction between zero and two gammas are emitted, so that a gamma multiplicity detector should supply a datum to distinguish a fission event from a scattering event. We processed as follows: A subnanosecond pulsed and bunched proton beam from the UML Van De Graaff generates nearly mono-energetic neutrons by irradiating a thin metallic lithium target. The neutrons irradiate a ^{235}U sample. Emerging neutron energies are measured with a time-of-flight spectrometer. A set of four BaF_2 detectors is located close to the ^{235}U sample. These detectors together with their electronic components identify five different events for each neutron detected, i.e. whether four, three, two, one, or none of the BaF_2 detectors received one (or more) gamma rays. The theory underlying this approach has been published [2]. We present the results of our fission neutron energy spectra.

[1]. D. Madland and J. Nix, Nucl. Sci. Eng. 81, 213,(1982)

[2]. C. Ji, G.H.R. Kegel, J.J. Egan, D.J. DeSimone et al, J. Nucl. Sci. and Tech. Supplement 2, 815(2002)